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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/625,490	07/22/2003	A. Farid Issaq	ACT-377	9116
28661	7590	08/09/2005	EXAMINER	
SIERRA PATENT GROUP, LTD.			KANG, DONGHEE	
P O BOX 6149			ART UNIT	
STATELINE, NV 89449			PAPER NUMBER	
			2811	

DATE MAILED: 08/09/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/625,490

Applicant(s)

ISSAQ ET AL.

Examiner

Donghee Kang

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 14 March 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-25 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-25 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 06 February 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>12/15/03, 6/22/05 &amp; 7/11/05</u> | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Election/Restrictions*

1. Applicant's election without traverse of Group I (Claims 1-25) in the reply filed on March 14, 2005 is acknowledged. Claims 26-52 have been cancelled.

### *Information Disclosure Statement*

2. Acknowledgment is made of receipt of applicant's Information Disclosure Statement (PTO-1449) filed December 15, 2003, June 22, 2005 & July 1, 2005.

### *Claim Objections*

3. Claims 7-8, 16-17 & 24-25 are objected to because of the following informalities: There are two lower adhesion-promoting layers. One of them should be - **upper adhesion-promoting layer**-. Appropriate correction is required.

### *Claim Rejections - 35 USC § 103*

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims **1-6, 8-9, 11-15, 17-18, 20-23 & 25** are rejected under 35 U.S.C. 103(a) as being unpatentable over Hawley et al. (US 6,437,365) in view of Jain et al. (US 6,107,165) and further in view of Gangopadhyay (US 6,114,714).

Re claims 1-3, 8-9, 11-12, 17-18, 20-21, & 25, Hawley et al. teach a metal-to-metal antifuse comprising (Fig.6):

a tungsten plug (18) disposed in a via in an insulating layer (16) disposed above and in electrical contact with a lower metal interconnection layer (14); a first layer of a barrier metal (42) disposed above and in electrical contact with said tungsten plug forming a first electrode, said first layer of said barrier metal comprising a titanium nitride (TiN); an antifuse layer (20) disposed above an upper surface of said tungsten plug, said antifuse layer comprising a lower adhesion-promoting layer (SiN, 22), a middle layer (24) comprising amorphous silicon, and an upper adhesion-promoting layer (SiN, 26); and a second layer of a barrier metal (30) disposed over said antifuse layer forming a second electrode, said second layer of said barrier metal comprising a titanium nitride; a second insulating layer, oxide layer (52) disposed over said first insulating layer, said antifuse layer, said first layer of said barrier metal, and said second layer of said barrier metal.

Hawley et al. do not teach that the SiN layers (22 & 26) are adhesion-promoting layer. However, the adhesion-promoting layer of this invention also comprises a SiN film. Therefore, SiN layer of Hawley et al. functions as “a adhesion-promoting layer” and would meet the recited term “a adhesion-promoting layer”.

Hawley et al. do not teach that the first and second barrier metals are comprise tantalum nitride. Jain et al. teach titanium nitride and tantalum nitride can be used for barrier metal (Col.4, line 66 – Col.5, line 3). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute the titanium nitride of Hawley with tantalum nitride as taught by Jain since titanium nitride and tantalum nitride are art recognized barrier metal material.

Neither Hawley nor Jain teaches middle layer comprises hydrogen doped amorphous carbon. Gangopadhyay teaches a hydrogen doped amorphous carbon used for antifuse material 2 (Fig.1). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute amorphous silicon with amorphous carbon since amorphous carbon may reduce ON-OFF switching and leakage current.

Re claims 4 & 13, Hawley et al. teach antifuse further comprising a spacer (32, Fig.3) disposed in physical contact with said antifuse layer, said first layer of said barrier metal, and second layer of said barrier metal.

Re claims 5, 14, & 22, Hawley et al. teach said antifuse layer having a thickness of 61 nm (Col.4, lines 29-32).

Re claims 6, 15, & 23, Hawley et al. teach the first and second barrier metal having a thickness of 200 nm (Col.4, lines 5-9 & Col.6, lines 26-30).

6. Claims **10 & 19** are rejected under 35 U.S.C. 103(a) as being unpatentable over Hawley, Jain, and Gangopadhyay, as applied to claims 1 & 11 above, and further in view of Forouhi (US 5,181,096).

Hawley et al. do not teach a tungsten layer atop the barrier metal layer. Forouhi in Fig.1 teaches a tungsten layer 30 formed on the barrier metal 28.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to combine the teaching Forouhi with Hawley in order to produce a device with a process compatible electrode.

7. Claims **7, 16, & 24** are rejected under 35 U.S.C. 103(a) as being unpatentable over Hawley, Jain, and Gangopadhyay, as applied to claims 1, 11, & 20 above, and further in view of Han et al. (US 6,583,953).

Hawley et al. do not teach SiC used as an adhesion-promoting layer for the carbon. Han et al. teach in Fig.4 SiC 60 forms an adhesion layer for Carbon 66 (Col.4, lines 21 – 24). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to provide a source of carbon as a cap at the interface of SiC in order to control the interface and potential loss of carbon during processing.

### ***Conclusion***

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Donghee Kang whose telephone number is 571-272-1656. The examiner can normally be reached on Monday through Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steve Loke can be reached on 571-272-1657. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should

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you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Donghee Kang  
Primary Examiner  
Art Unit 2811

dhk